

## EMANUEL EDWARD KLEIN'S BOOK ON DISEASES OF BIRDS

### KNJIGA EMANUELA EDWARDA KLEINA O BOLESTIMA PTICA

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#### SUMMARY

*Emanuel Edward Klein (1844 - 1925) was a British microbiologist of Croatian origin. He was born in Osijek in what is currently the Republic of Croatia and which was then part of the Habsburg Monarchy, he completed his medical studies in Vienna in 1869, and went on to spend his entire career in London. Although trained as an anatomist, embryologist and histologist, his main area of research was microbiology. Due to the fact that back then it was a new and fast developing discipline, he was able to pursue his interests in many directions and make significant discoveries, such as the identification of the 'Bacillus enteritidis sporogenes' as a cause of summer hospital diarrhoeas. Although the overwhelming majority of his researches dealt with bacteria which attacked humans, in 1892 he published a book entitled The Etiology and Pathology of Grouse Disease, Fowl Enteritis, and Some Other Diseases Affecting Birds, which revealed the results of his experiments on the bacteria which affected birds. In the context of the general development of the microbiology, this paper tries to give an objective evaluation of this until now widely neglected book.*

**Key words:** microbiology; history of microbiology; diseases affecting birds; fowl enteritis; grouse disease

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## INTRODUCTION



Emanuel Edward Klein

Microbiology is a science about microorganisms, comprising all microscopic life forms that cannot be seen with the naked eye. It is composed of bacteriology (study of bacteria), virology (viruses), mycology (fungi), parasitology (parasites), and other branches. Its most famous representatives were the French, Louis Pasteur (1822-1895), and the German, Robert Koch (1843-1910), while Emanuel Edward Klein formed the foundations of the British microbiology [1]. He was born on the 31st October 1844 in Osijek, in the Virovitica County,

in the Kingdom of Slavonia, in the

current Republic of Croatia, which was then part of the Habsburg Empire, to a German speaking, non-observant Jewish family, and in his hometown he finished the grammar school and graduated in 1863. With the help of a scholarship he studied medicine in Vienna and obtained the M.D. in 1869, but actually never practised medicine. At first he worked with the physiologist Ernst von Bruecke (1819-1892), and later with the pathologist Salomon Stricker (1834-1898), who thought him methods and techniques in histology and embryology [2].

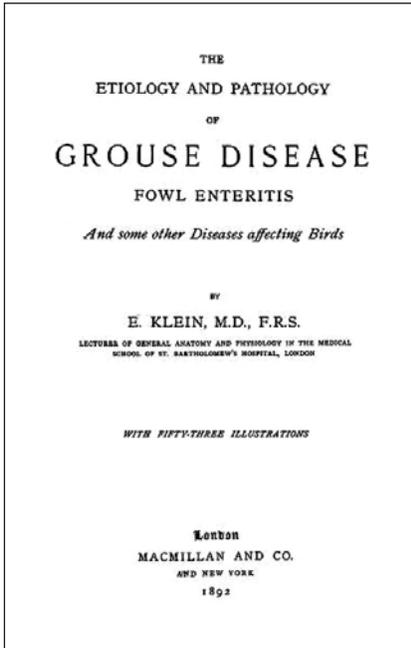
In 1869 he was sent to England to determine terms for the translation of Samuel Stricker's manual *Handbuch von den Geweben des Menschen und der Tiere* (Leipzig 1869-1872, London 1870-1873). Klein himself contributed two chapters, one on the termination of the fine nerves in the tadpole's tail and another on the development of the blood vessels in the chicken embryo. During his visit he was introduced to the physiologist John Scott Burdon Sanderson and the pathologist John Simon, on whom he made an excellent impression, and was thus invited to move to Britain in order to work with them, first in 1871 with Sanderson in his work on tubercle at his private laboratory in Howland Street, and then since 1873 as an Assistant Professor of Comparative Pathology at the Brown Sanitary Institution in order to conduct

pathological, clinical and epidemiological researches under the supervision of Simon [3]. His excellent knowledge in morphology and histology enabled him to direct his interests towards microbiology which was then a new and fast developing discipline. Although he was a self-taught pioneer, he zealously implemented the Continental improvements into his work and educated generations of further microbiologists such as the malaria researcher Sir Ronald Ross, which earned him an epithet of 'the father of the British microbiology' [4].

In the period between 1868 and 1910 Klein published 264 scientific papers, among which 200 were on microbiology, wrote almost one hundred *Reports of the Local Government Board* on his experimental work regarding the causation of infectious diseases, thus helping the foundation of preventive medicine, and published several important books [5]. Among them, one should mention *Micro-organisms and disease: an introduction into the study of specific micro-organisms* [6] as the first British microbiological handbook ever published. One of his least known works is a book entitled *The Etiology and Pathology of Grouse Disease, Fowl Enteritis, and Some Other Diseases Affecting Birds* which was based on his researches conducted in his own microbiological laboratory in the Saint Bartholomew's Hospital in which he worked since 1873 as a Lecturer on General Anatomy and Physiology [7].

#### THE ETIOLOGY AND PATHOLOGY OF GROUSE DISEASE, FOWL ENTERITIS, AND SOME OTHER DISEASES AFFECTING BIRDS

Since 1887 until 1892 Klein conducted a series of researches on the dead birds sent to him from the various parts of Britain. Birds were acquired by donation: grouse from the editor of *Field*, fowls from Mr W. Cook of Orpington and Mr C. Wellington, and pheasants from Mr Douglas of Ayrshire. The result of his work was the above mentioned book which was divided into two parts, the first one composed of eight chapters on grouse disease, and the second one of the remaining six chapters on fowl cholera, fowl enteritis, and cramps in young pheasants [8]. Regarding the nature of grouse disease he observed that although it had usually affected red grouse (*Lagopus Scoticus*) in Scotland, North of England, Wales and Ireland during April, May and June, it suddenly switched from endemic to epidemic disease. His observations on its symptoms and pathology conducted in Cumberland showed acute infectious pneumonia and general venous congestion in call, which was feeble and hoarse, with change of feathers and duller eyelids, and



Klein E. The Etiology and Pathology of Grouse Disease, Fowl Enteritis, and Some Other Diseases Affecting Birds. London: Macmillan, 1892.

yellow-ammer (greenback, cockbit, finch), occasionally in rabbits, but not in pigeons and fowls. He also described the autumnal disease variation characterised by the oval or rod mobile microbes present in heart blood and concluded that the autumnal microbe was the attenuated form of the spring one, which made a possibility of development of vaccine. Based on his discoveries that it had not formed spores, while drying killed partially and heating at 60 C killed completely all microbes, he proposed the killing of birds and burning their bodies as prevention against the disease. Klein's general considerations regarding the 'Bacillus of the Grouse Disease' were summarized as:

- Constant appearance in lungs and livers of diseased birds
- Definite characters in various media
- Transmission to animals causes disease
- Similar pathological appearance
- Transmission not just subcutaneously, but also directly
- Constant appearance in infected animals [8]

whose crop was full of indigested heather with legs without feathers, congested lungs, hyperaemic larynx and trachea, red pneumonia hepatisation, dark un-enlarged spleen, and dark soft liver.

Klein then described the character of the 'Bacillus of the Grouse Disease' with cultural characteristics of grey, translucent, flat, angular dots, which are in fresh state spherical or oval corpuscles with rounded ends with active Brownian movements with flagella of cylindrically shaped bacilli which are 0,4 - 1,6 microns thick. His experiments on the laboratory animals showed that the disease was not transmitted by feeding, while subcutaneous inoculations resulted in oedematous and haemorrhagic tissues in mice, guinea-pigs, common bunting and

In the Chapter number VIII Klein described a 'Garden Earth Bacillus' for which he stated that it had caused fatal infection in some rodents. He also stated that it was different from the Koch's 'Garden Earth Bacillus', because it was aerobic and non-spore bearing, while the other one was anaerobic and spore bearing, and caused malignant oedema in guinea pigs. His experiments conducted on mice showed that the mentioned bacilli were antagonistic, which proved that they were different species, because the action of the one was neutralised by the action of the other [8].

Klein also observed the acute and fatal epidemic disease amongst fowls at a poultry farm in Kent during the early part of 1889, which he was investigating through the examination of fowls by microscope, cultivation and experimentation, and called the new disease fowl enteritis, as opposed to chicken cholera which was absent from England and described by Pasteur. Its post-mortem appearance was a heart full of coagulated blood, normal lungs, red intestines, mucus in appendix, greenish-yellow fluid faecal matter in rectum, enlarged spleen, enlarged, soft and flabby liver, absence of haemorrhages with the enteric disturbance as a prominent symptom, while the bacteria found in the mucus of the intestine after the subcutaneous inoculation in fowls, pigeons or rabbits produced death in one or two days. According to him a cultivation of the 'Bacillus of Fowl Enteritis' was possible from a droplet of blood taken from the heart, which always yielded a pure cultivation of colonies of greyish translucent dots with white translucent discs of conspicuously slow growth, while gelatine was never liquefied by the growth. His experiments on the laboratory animals showed that the disease was reproducible by feeding eight fowls with intestinal contents, but not with cultures, which then developed the characteristic disease on the 5<sup>th</sup>-7<sup>th</sup> day and died on the 7<sup>th</sup>-9<sup>th</sup> day, while pigeons, rabbits, guinea-pigs, and mice were susceptible to fowl cholera, but not to fowl enteritis. Starting with the observations that the 'Bacillus of Fowl Enteritis' had not formed spores, while the fowls which had passed through the first mild attack of the disease were possessed of the immunity against the second attack, Klein suggested the prevention measures:

- Every fowl that shows any suspicion of the disease should be at once removed, killed, and burned
- The remaining fowls should be at once transferred to new grounds, and if practicable, should be subdivided in separate small flats

- The ground from which the affected fowls have been removed should be turned, disinfected with quicklime, and not used for fowls for a considerable time [8]

In the last chapter Klein described cramps in young pheasants which he observed during his stay at Blairquhan during June 1887. Disease started with lameness of one leg and the unwillingness to move, next day both legs were lame, the birds were sitting quietly and dragging themselves, the following day they were motionless, with closed eyes, they did not feed, and they died. He observed acute periostitis and acute osteomyelitis with haemorrhages in the periosteum and the surrounding muscle more often in posterior than anterior limbs. A few minute oval or cylindrical bacilli were constantly found in cramps. Streak subcultures on gelatine were very characteristic by the slowness of the growth and absence of a continuous band-like growth, gelatine was never liquefied by the growths, and bacilli were without motility [8].

## EVALUATION

Although not the first book ever written on the diseases of birds, *The Etiology and Pathology of Grouse Disease, Fowl Enteritis, and Some Other Diseases Affecting Birds*, is certainly one of the most thorough works on the subject. Klein's research of bird diseases could be compared with Pasteur's on the disease of silk-worms [9] and Koch's on bovine tuberculosis [10]. Although neither of them was researching zoonosis as diseases which attack both humans and animals, which would be a logical next step having in mind their investigations of human diseases, all of them have directed their interests towards diseases affecting animals involved in the important sources of their states incomes, because the mentioned industries were in the end financing their works as well [11,12]. While Pasteur's influence is visible from Klein's movement from the laboratory to the field in order to investigate diseases in their natural habitat, Koch's impact is obvious from Klein's implementation of his postulates in his experiments namely the isolation of the microorganism from the affected bird, its cultivation in the right media, then its inoculation into the healthy laboratory animal, and finally its repeated isolation from the now diseased laboratory animal. Although having given credits to his colleagues, Klein also insisted on the correctness of his findings if they contradicted theirs, such as in the examples of Koch's 'Garden Earth Bacillus' and Pasteur's chicken cholera.

In conclusion one should mention that Klein was right in his descriptions of the characteristics of the 'Bacillus of the Grouse Disease' and the

'Bacillus of Fowl Enteritis', although they are today known as *Clostridium botulinum* and *Clostridium perfringens*. He was also correct by stating that the British fowl enteritis and the French chicken cholera were different diseases, because today it is known that the first one is caused by the already described *Clostridium perfringens* and the second one by *Pasteurella multocida* which was named after its above mentioned discoverer Louis Pasteur [13]. Klein's thorough descriptions of his experiments make them easily reproducible, while his conclusions still remain valid, which combined make his book an interesting read even today.

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## SAŽETAK

Emanuel Edward Klein (1844. - 1925.) bio je britanski mikrobiolog hrvatskoga podrijetla. Rođen je u Osijeku te je završio studij medicine u Beču 1869., a cijelu svoju karijeru je proveo u Londonu. Iako obučan kao anatom, embriolog i histolog, njegovo glavno područje istraživanja bila je mikrobiologija. S obzirom na činjenicu da je to tada bila nova i brzorazvijajuća disciplina, Klein je bio u mogućnosti usmjeriti svoje interese u različitim smjerovima i napraviti značajna otkrića, poput identifikacije 'Bacillus Enteritidis sporogenes' kao uzroka ljetnih bolničkih proljeva. Iako se velika većina njegovih istraživanja bavila bakterijama patogenima za ljude, 1892. objavio je knjigu pod naslovom *The Etiology and Pathology of Grouse Disease, Fowl Enteritis, and Some Other Diseases Affecting Birds*, koja je pokazala rezultate njegovih pokusa s bakterijama patogenima za ptice. U kontekstu općega razvoja mikrobiologije ovaj rad pokušava dati objektivnu procjenu toga do sada uglavnom zanemarenoga djela.

**Ključne riječi:** mikrobiologija; povijest mikrobiologije; ptičje bolesti; enteritis peradi; bolest jarebica